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VALUE OF HEAVY MINERAL INVESTIGATIONS IN THE COASTAL PLAIN OF SOUTH CAROLINA

By

Charles J. Cazeau 1/

Heavy mineral investigation is a neglected aspect of sedimentary petrology in the study of Cretaceous and Tertiary sediments in the Coastal Plain of South Carolina.

Recently the writer examined heavy mineral separates from the Tuscaloosa Formation (Upper Cretaceous); the Black Mingo, Congaree, and Warley Hill Formations of Eocene age; and a post-Eocene sand unit. These samples were collected within a radius of 35 miles of Columbia, South Carolina. The purpose of this cursory study was to determine if any striking differences in the heavy mineral suites existed within this group of units.

Each sample from these formations yielded an abundant heavy mineral residue. As expected the opaque minerals constituted the bulk of each sample, usually in excess of 55 percent. The most common opaques were magnetite-ilmenite; but hematite, leucoxene, and opaque rutile were present in varying amounts. The opaques exhibited a wide range of degree of roundness.

The transparent heavy minerals are more valuable in assessing correlation and provenance than the abundant opaques. The following table shows the percentages of these transparent minerals found in each of the formations investigated (opaque percentage neglected):

MINERAL	TUSCALOOSA	CONGAREE	BLACK MINGO	WARLEY HILL	POST-EOC SAND UNIT
TOURMALINE	85	15	41	14	67
ZIRCON	6	20	22	35	12
SILLIMANITE	Tr	9	17	4	abs
RUTILE	6	7	3	23	21
GARNET	abs	Tr	9	abs	abs
MONAZITE	abs	abs	2	abs	abs
KYANITE	abs	48	2	21	abs
OTHERS	2	1	4	3	--

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While several of these minerals are shared in common by all of the units as can be seen from the table, the relative abundance varies widely. It was observed that several varieties of tourmaline (brown, black, mauve, and colorless) and zircon (colorless and purple) are present. These minerals also displayed differences in degree of rounding and type of inclusions. Although brown tourmaline is abundant, several grains are anhedral and characteristically contain numerous acicular inclusions. Black tourmaline was usually inclusionless. Zircons were both euhedral and well rounded. Such features of course provide clues to the character of the source rocks and the history of transportation.

These differences indicate that regional heavy mineral studies of specific formations may be fruitful. In such future investigations in the Coastal Plain it is suggested that the following features of heavy mineral suites may be significant:

(1) heavy mineral varieties based on color or unusual optical properties
(2) degree of roundness of each mineral variety
(3) type of inclusions in heavy minerals
(4) ratios of heavy mineral varieties to one another.

These details of heavy mineral suites should be a valuable aid to deciphering the geologic history of sedimentary units in the Coastal Plain. In addition, increased attention to heavy mineral suites may assist in the discovery of commercial deposits of specific minerals such as ilmenite and monazite.

LEACHING OF SANTEE LIMESTONE, CALHOUN COUNTY, SOUTH CAROLINA

By

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INTRODUCTION

The purpose of this report is to present the results of a laboratory investigation of the Santee Limestone (Middle Eocene) and an overlying sandy unit presumably derived from the Santee by leaching. The samples for this study were obtained from the Hutto Pond area, Calhoun County, South Carolina (S. C. Division of Geology Locality 9-32).

In the Hutto Pond area the Santee is friable, white to cream colored impure limestone. It is underlain by the Warley Hill Formation and overlain by an orange-brown to pink, sandy, friable stratum 10'-15' thick. The overlying stratum is massive and exhibits small slump structures within it. These slump features and the general appearance and position of the unit are the major field evidence supporting the belief (Henry S. Johnson, Jr., personal communication) that it is a residuum derived from the leaching of the impure Santee Limestone. Elsewhere in the State the Santee commonly exceeds 90% calcium carbonate (Heron, 1960). Comparison of heavy mineral crops in insoluble residues of the Santee and the overlying stratum was undertaken to test the residuum hypothesis.

The writer wishes to acknowledge the helpful suggestions of Henry S. Johnson, Jr., who accompanied him in the field, and C. Q. Brown who confirmed the presence of sillimanite in the samples by X-ray methods.

METHODS

Samples of Santee Limestone collected in the Hutto Pond area were digested in cold dilute hydrochloric acid to obtain the insoluble residue. The amount of sand and silt-clay were determined in addition to the percentage of calcium carbonate. Heavy minerals in the sand fraction ($\frac{1}{4}$mm-1/16mm) were separated by means of bromoform, mounted in Canada balsam, and counted with the aid of a petrographic microscope. Samples of the overlying stratum were accorded similar treatment.

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RESULTS

After drying and weighing of the insolubles from the Santee and the overlying stratum, the following results were tabulated:

	Santee Ls.	Overlying stratum
Percentage of calcium carbonate	78%	0%
Percentage of insoluble residue	22%	100%
Percentage of sand (> 1/16mm)	66%	71%
Percentage of silt and clay	34%	29%

Binocular microscope examination indicated that sand-sized insolubles of both the Santee and the overlying stratum consisted principally of clear quartz grains ranging from angular to subangular. Both were highly micaceous.

The sand from the Santee and the overlying stratum contained an abundant heavy mineral crop exceeding 2% of the total sand fraction. The opaque heavy minerals comprised 80% of the heavy mineral crop. The most common heavy opaque was bluish-black subround magnetite with minor amounts of ilmenite, leucoxene, and iron oxide.

The more diagnostic transparent heavy minerals were counted according to the method of Doeglas (1940), who counts at least 100 transparent minerals after first evaluating the precentage of the more abundant opaque minerals. In this way, the masking effect of the opaque minerals is reduced and a more accurate assessment of the less abundant transparent heavy minerals is possible. Results are as follows:

Heavy mineral	Santee Ls.	Overlying stratum
Sillimanite*	45%	46%
Zircon	35%	36%
Tourmaline	9%	10%
Rutile	7%	6%
Staurolite	2%	Tr
Others	2%	1%

*verified by X-ray

Sillimanite, the most abundant transparent mineral, is the non-fibrous variety and occurs mainly as elongate striated grains. Zircons are colorless rounded to subrounded euhedra. The tourmaline consists of subrounded irregularly shaped grains of the brown and black variety.

CONCLUSIONS

The identical order of abundance and close similarity of the percentages of the transparent heavy minerals is remarkable. These results strongly corroborate the field evidence that the stratum overlying the Santee Limestone at Locality 9-32 (Hutto Pond) in Calhoun County is a residuum derived from protracted leaching of the Santee.

REFERENCES

Doeglas, D. J., 1940, The importance of heavy mineral analysis for regional sedimentary petrology: Rept. Comm. Sedimentation, 1939-1940, Nat. Res. Council, 108 p.

Heron, S. D., 1960, Notes on the calcium carbonate content of the Santee limestone: Geologic Notes, vol. 4, S. C. State Dev. Bd., Div. of Geology.

CONTOURS DRAWN ON TOP OF THE COOPER MARL IN THE LADSON QUADRANGLE, SOUTH CAROLINA 1/

By

Donald J. Colquhoun 2/

ABSTRACT

Contours drawn on top of the Cooper Marl in the Ladson Quadrangle, South Carolina, are depicted through the use of published information, power auger holes, and hand operated seismograph records. The surface of the Cooper Marl was probably influenced by fluvial erosion and marine erosion previous to the Recent. Deep fluvial valleys can be noted on top of the Cooper overlain by Pleistocene sediments, approximately reflecting present drainage. A scarp probably related to marine erosion can be noted trending southwest to northeast in the northern part of the quadrangle. A similar somewhat suppressed scarp can be noted in the southeastern portion of the quadrangle. These probably reflect similar scarps developed at the surface.

ECONOMIC MINERAL LOCALITIES IN SOUTH CAROLINA 3/

By

L. L. Smith 2/

ABSTRACT

Locations of metallic and non-metallic mineral deposits are shown on an outline map of South Carolina (scale 1" = approximately 12 miles). Appropriate symbols are used to indicate currently active deposits as well as some inactive ones exploited within recent years.

The map is accompanied by brief text describing the occurrences.

1/ Map and text published as MS-4 by Division of Geology, S. C. State Development Board, 1961.
2/ Department of Geology, University of South Carolina.
3/ Map and text published as MS-5 by Division of Geology, S. C. State Development Board, 1961.

GENERALIZED GEOLOGIC MAP OF SOUTH CAROLINA 1/

By

W. C. Overstreet and Henry Bell III 2/

ABSTRACT

This 8 x 14 inch one color map shows county outlines and major geologic divisions of the State. The Coastal Plain section is not subdivided but the Piedmont and Blue Ridge provinces are divided into the Blue Ridge, Brevard, Inner Piedmont, Charlotte, Kings Mountain, and Carolina Slate belts. The map is intended as an index to the geology of the State and is adapted from a U. S. Geological Survey open file report by W. C. Overstreet and Henry Bell III (1961, Provisional geologic map of the crystalline rocks of South Carolina).

1/ Published as MS-6 by Division of Geology, S. C. State Development Board, 1962.

2/ U. S. Geological Survey, Beltsville, Maryland